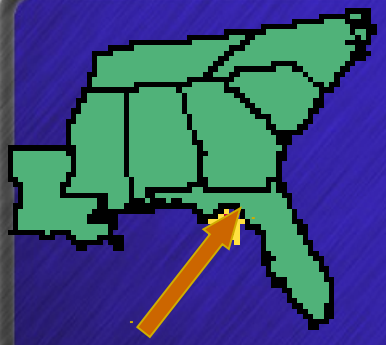
HYBRID Propellant for Small, Medium and Large Caliber Applications

St. Marks Powder

Agenda

- Plant Overview
- HYBRID Propellant Technology
- Small Caliber Applications
- Medium Caliber Applications
- Large Caliber Applications
- Summary



St. Marks Powder

Producing Propellant Since 1970

- **1974 acres, 137 buildings, 6.5 miles of roads**

- **Propellant production**

  > 150 products

  Product mix 50% Military & 50% Commercial

  Largest producer of military and commercial small arms propellant in the U.S.

HYBRID Gun Propellant

New From St. Marks Powder

PERFORATED • DETERRED

Ultimate ballistic efficiency achieved by combining perforated geometry with burn rate modifiers (deterrents)

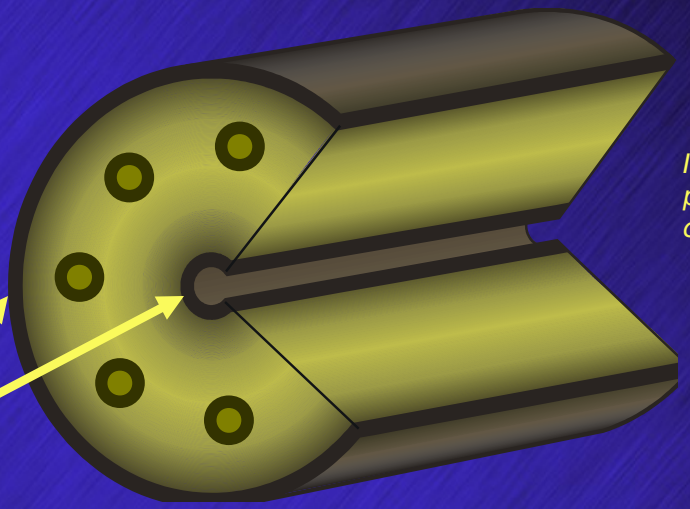


Illustration of a propellant grain cross section

Deterrent Layer - applied to tailor the burn rate for specific applications to optimize ballistic efficiency

HIGH PERFORMANCE - Optimum burn progressivity
High loading densities

COOL BURNING - Low erosion & low flash

ECONOMICAL - Modified conventional process

GENERAL DYNAMICS
Ordnance and Tactical Systems

HYBRID Propellant is Manufactured in Single, Seven, and Nineteen Perf Geometries for Application Flexibility

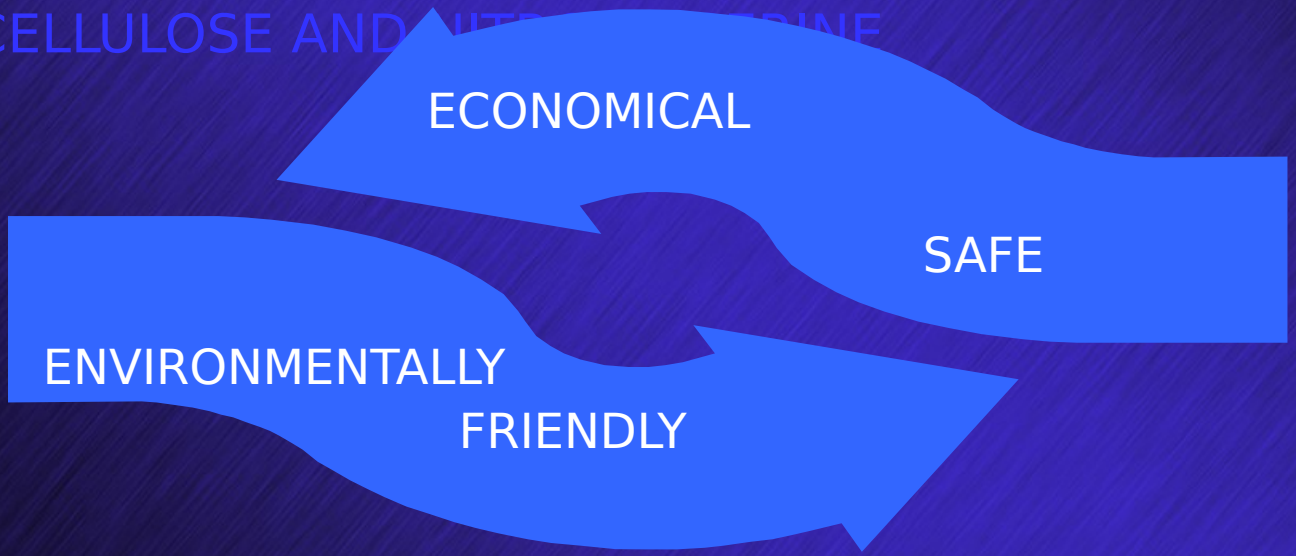
- Single Perf for reduced barrel wear (cooler burning)

- Seven Perf for higher energy performance (less deterrent)

- Nineteen Perf for greatest bed permeability

Manufacturing Process

HYBRID PROPELLANTS ARE PROCESSED UNDERWATER IN A SAFE, ECONOMICAL AND ENVIRONMENTALLY FRIENDLY MANNER - THEY UTILIZE CONVENTIONAL PROPELLANT INGREDIENTS: NITROCELLULOSE AND [illegible]



HYBRID Propellant for Small Caliber Applications

- Due to its progressive geometry and chemistry, HYBRID propellants are ideal for small caliber rifle applications
  - Demonstrated 10% charge weight reduction in centerfire rifle applications with excellent temperature sensitivity
  - Great for long range sniper applications

HYBRID Propellant for Medium Caliber Applications

St. Marks Powder HYBRID Propellant Super 40MM Air Burst Test Summary:

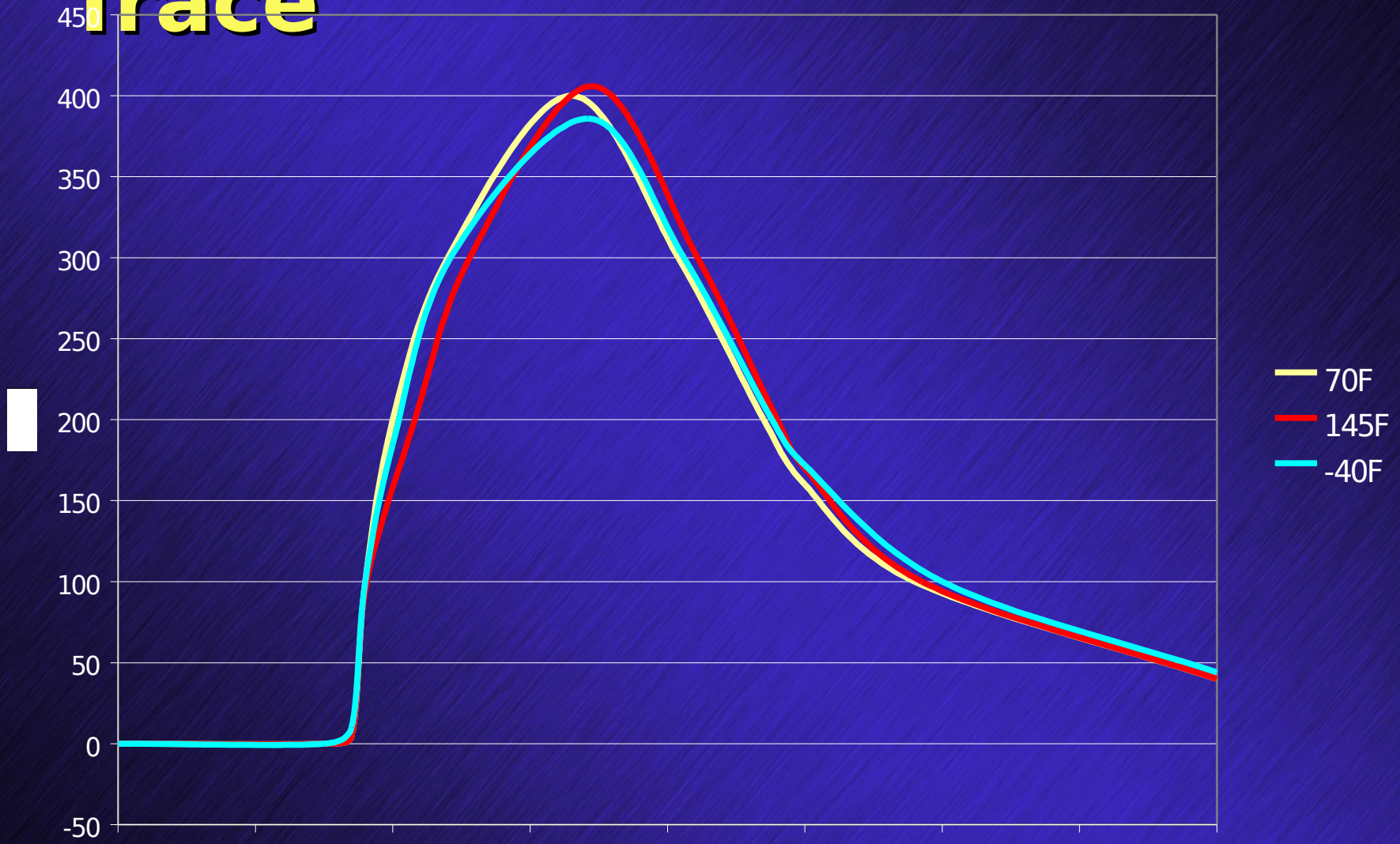
Target Velocity = 1050 mps at P+3SD< 480 MPa

Temp	Velocity	Pressure	Action Time
+70º F	1049 mps	399 MPa	4.13 ms
-65º F	1046 mps	402 MPa	4.08 ms

Achieved the same velocity as the 30mm GAU-8/A (same envelope) with a 675g 40m projectile compared to the standard 367g 30mm projectile.

GENERAL DYNAMICS
Ordnance and Tactical Systems

40mm AB Pressure-Time Trace



GENERAL DYNAMICS
Ordnance and Tactical Systems

Increased Muzzle Energy through Compaction

- HYBRID propellants are plastic in nature and compressible. Through the utilization of High Density Propelling Charge Technology (HDPC) the charge weight was increased by 30% over loose loaded propellant.

- Benefits of compacted propellant versus optimal loose HYBRID propellant
  - 22% increase in muzzle energy
  - Lower Flame Temperature (50°K)
  - Improved Temperature Performance

HYBRID Propellants for Large Caliber Applications

- HYBRID Propellants can be produced with flame temperatures ranging from 2,000°K (Impetus = 800 j/g) to 3,500°K (Impetus = 1150 j/g) for a variety of applications
  - Multi-Perf, high energy formulations are ideal for advanced KE, direct fire ammunition
  - Low Flame Temperature HYBRID propellants provide exceptional ballistic performance and extended barrel life for high cyclic rate Army and Navy indirect fire applications

Large Caliber Test Results

105mm M900 HYBRID Demonstration April ’02 @YPG

Demonstrated Velocity Increase

7 Perf HYBRID + 60.0 Meters/Second

3 Round Std. Dev. = 1.6 M/S

Baseline Propellant 3 Round Std. Dev. =

St. Marks Powder

GENERAL DYNAMICS
Ordnance and Tactical Systems

HYBRID Propellant for FCS Applications

HYBRID Propellant

The New Technology Provides:

- *The highest possible muzzle velocity for Maximum Range*
- *A Lower Flame Temperature for Extended Barrel Life and No Muzzle Flash in most applications*
- *Environmentally friendly domestically produced raw materials*
- *Low Cost Conventional Ingredients*
- *Applicable to the full spectrum of envisioned Precision Guided Munitions (PGMs) and related propulsion systems.*